Chapter 6
New Features of Open Textbook for Integrative STEMx Education:
Open Textbook for Science Education

ABSTRACT

Over the last 10 years it was observed that scientific literacy has two orientations: (1) scientific content is presented to be used later for anything and (2) scientific content is presented to be used in life. According to data provided by the Michigan State University, STEM (i.e., science, technology, engineering, and mathematics) occupations are growing at nearly two times the rate of the non-STEM jobs. In addition, many fields are seeking employers with STEM-related skills, such as problem solving, critical thinking, and technical abilities. Thus, as STEM has progressively expanded, there is a perceived need for new focused on high-demand jobs in scientific literacy. For open textbooks to be a unique experience in STEM education, it is important to design new features. This chapter explores the open textbook area for integrative STEMx education. It considers how open textbooks can provide students a unique way forward to learn about learning strategies and to develop global skills on-demand. The conclusion is provided at the end.

DOI: 10.4018/978-1-5225-5305-2.ch006

INTRODUCTION

Workforce needs to be well-versed in science, technology, engineering, and math. This statement was a starting point for identification more creative, innovative and intelligent ways of education. In 1990 the National Science Foundation (NSF) of USA has used the STEM as a generic label for every event, policy, program or practice that involves one or several disciplines in science. Initially, STEM was only a concept. In pedagogy, the acceptance of STEM was focused on replacing the traditional lecture-based teaching strategies with more inquiry and project-based methods. However, for nearly two decades STEM was a simple acronym for science, technology, engineering, and/or mathematics. Thus, Bybee (2010, p. 30) notes that most professionals in STEM-related fields lacked an understanding of the acronym STEM.

Nowadays, STEM terminology is taking multiple forms: STEM, STEAM, STEMM, STREAM, etc.

A review of the literature over the past ten years allow us to evidence that STEM terminology "remains a source of ambiguity" (Sander, 2009, p. 20). In order to clarify this issue let us place the following metasystems delimitations: a) 1990 – 2006; b) 2007-2010, c) 2011-2015 and c) 2016-present. This methodology allows to evidence the following metasystem(s) transitions:

- **STEM1.0:** A generic label for an event, policy or practice that involve science disciplines;
- **STEM2.0:** Emergence of concepts: "*STEM Education*" and "*Integrative STEM Education*";
- **STEM3.0:** The emergence of the concept "*STEAM Education*";
- **STEM4.0:** The fusion of STEM Education programs (the model of STEMx Education).

The most important event seems to be the program "*Integrative STEM Education*" (Bybee, 2010, p. 32) aims to explore the teaching and learning approach between science areas or between science and other subjects. The program's pedagogy was called "*Purposeful Design and Inquiry*" (Bybee, 2010, p. 33) aims to combine technological design with scientific inquiry and to engage students in scientific inquiry and problem-solving where students develop innovative solutions to real-world problems and test ideas.

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Xinhong Xia, Xianglan Chen, Jing Zhang, Hongliang Louand Yachao Duan (2022). *International Journal of Technology-Enhanced Education (pp. 1-15).*
www.irma-international.org/article/is-schema-theory-helpful-in-teaching-and-learning-based-on-visualizing-research/300332